Recent Research in Science and Technology 2014, 6(2): 01-03
ISSN: 2076-5061
Available Online: http://recent-science.com/

Urea and ascorbic acid as ameliorators of cement dust toxicity in *Oryza Sativa Var.* B.P.T.5204

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Abstract
The present study is an attempt to find out the amelioration of urea and ascorbic acid on the inhibitory effect of cement dust on *Oryza Sativa* (Var. B.P.T.5204). The observations have shown that rice was quite sensitive to cement dust when applied at 3g/m^2 daily from three leaf stage until harvest of the crop. The response was analysed in terms of number of leaves, total height, biomass and panicle characters. Urea and ascorbic acid were observed to be quite potent in reverting the inhibitory effect of cement dust. Urea could bring the maximum recovery in shoot and root biomass. These two substances were very useful in reverting the effect of cement dust in terms of height of the plant. Urea increased seed weight upto 35% while ascorbic acid upto 13.4%.

Keywords: Urea, ascorbic acid, *Oryza Sativa*

INTRODUCTION

Cement dust is a common air pollutant around cement factories and construction sites. Chemically it is a mixture of oxides of calcium, potassium, aluminum, silicon and sodium. It has the property of setting into a hard mass forming a thick crust when it comes in contact with water. It leads to a decrease in water holding capacity of soil, increase in pH, conductivity, Ca and Al, and decrease in nitrogen availability thereby affecting the plant growth. Cement dust also affects plant growth directly by clogging the stomata. Crust formation on leaves, alkalinity of stigma surfaces reducing the pollen germination (Anderson, 1914; Parthasarathy *et al*., 1975) and decrease in size and number of leaves and height of plants. Further, cement dust toxicity is specific and is an intrinsic factor of soil and leaf characters of a given species. Hence, a comprehensive study encompassing the physiochemical factors of soil and leaf characters at different stages of growth are very much needed to draw a relation between the tolerance level and kind of injury imposed. The present attempt has been made to investigate the effect of cement dust on *Oryza sativa* (Var. B.P.T.5204) considering the limited information available on this aspect The main objectives were (i) to characterize the various plant parameters affected (ii) to identify the susceptible stage of plant growth for cement dust toxicity and (iii) to revert the toxic effect of cement dust by urea and ascorbic acid.

MATERIAL AND METHODS

Experimental plots of one square meter area were prepared and were entirely irrigated and fertilized. Seeds of rice were sown 10 cm apart. Plants were dusted with cement dust @ 3 g/m^2 from three leaf stage until harvest with the help of a hand rotary duster. Dusting was done during morning hours every day. Plants were enclosed in an open top polyethylene chamber at the time of dusting in order to prevent the loss of dust due to the action of wind. Along with the dust, 50mg urea and 100 ppm ascorbic acid were added separately to the soil every day to find out their potential in reverting the inhibitory effects of cement dust untreated plants constituted the control and three replication were maintained. Plant samples were collected at 15 day intervals and observed for different characters, *viz.* number of leaves, total height, biomass, 1000 seed weight, number of panicles/plant and size of panicle. Soil samples were collected from different treatment plots and at different stages of growth. Soil was analysed for PH, organic matter and electrical conductivity (Anon., 1975).

RESULTS

Biomass

The effect of cement dust on root and shoot biomass and its recovery is presented in Table 1. Shoot biomass was observed to be more than that of control from 15th to 45th day in dusted plants. The maximum was recorded on the 45th day, i.e. 75% more than control. Then it was found to decrease which continued till the harvest of the crop. The maximum decrease (65%) was recorded on the 75th day. Shoot biomass was more than that of control until 45 days in urea and ascorbic acid treated plants. There was less decrease in shoot biomass with the increase in age in urea treated plants when compared to dusted plants. There was an increase in root biomass till 45th day in dusted plants which was 34.8% more than that of control. Thereafter, it showed a decreasing trend and the maximum decrease was found on the 75th day.

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Table 1. Effect of cement dust, urea and ascorbic acid on percentage reduction and recovery of biomass of *Oryza Sativa*

Plan age (days)	Control		Cement dust		Cement dust +urea		Cement dust + ascorbic acid	
	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root
30	0.11	15.0	0.5*	0.26*	27.0*	28.0*	45.0*	56.0*
45	0.4	0.36	75.0*	34.88*	137.0*	36.66*	125.0*	39.0*
60	3.15	2.0	43.0	61.5	40.0	40.0	31.0	30.0
75	5.85	2.3	65.0	81.7	24.0	46.08	36.0	21.7
90	10.4	2.6	40.86	56.15	12.0	23.4	26.0	30.07
120	12.3	2.8	43.0	55.3	9.0	39.28	21.0	28.57
150	14.3	2.9	45.0	62.06	4.0	25.1	28.0	20.34

+Control indicates the original biomass values (g/m^2); *Percent increase over control.

Length

The data on root and shoot length in relation to cement dust pollution are presented in Table 2. It is evident from the data that the vegetative characters are greatly affected. Till the 45th day there was a slight increase in the shoot length in dusted plants (26.5cm) against that of control (24 cm). After the 45th day, until harvest, there was a gradual decrease in the shoot length. Urea and ascorbic acid were very effective in reverting the toxic effect of cement dust. Similar effects were noticed on root length which were more pronounced than in the case of shoots.

Number of Leaves

The number of leaves showed an increasing trend until 60 days in dusted plants and later decreased with the increase in age (Table 3). Urea and ascorbic acid treatments have not brought in any improvement in number of leaves.

Table 2. Effect of cement dust, urea and ascorbic acid on height (cm) of *Oryza sativa.*

Plan age (days)	Control		Cement dust		Cement dust +urea		Cement dust + ascorbic acid	
	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root
30	15.6	5.0	17	7.5	18	7.8	17.6	8.0
45	24.5	10.0	26.5	12.0	26.7	13.5	28.15	14.66
60	36.6	18.3	31.35	12.06	35.33	13.9	34.55	16.33
75	44	19.0	35	13.5	42.25	14.1	38.1	16.5
90	47	21.75	37.5	14.0	44.5	16.5	40.5	17.25
120	52.5	24.23	48.5	14.59	49.25	16.16	50.1	18.25
150	56.6	24.66	48	15.2	50	16.75	53.75	18.55

Table 3. Effect of cement dust, urea and ascorbic acid on the leaf number of *Oryza sativa.*

Plan age (days)	Control	Cement dust	Cement dust +urea	Cement dust + ascorbic acid
30	4.0	4.3	4.6	5.2
45	5.0	7.3	11.0	8.6
60	11.0	11.2	16.6	12.0
75	17.5	12.2	17.0	14.4
90	21.0	14.0	19.5	16.6
120	23.0	11.5	20.0	18.0
150	23.5	12.0	20.6	19.5

Panicle characters

The panicle number and size, and weight of 1000 grain obtained from the dusted plants were lower than those of control (Table 4). The average number of panicles plant in dusted plots was 3.33 as against the control value of 4.5. The number of panicles increased in urea (11) and ascorbic acid (7.7) treatments. There was a decrease in the panicle size also because of the cement dust. Similarly, there was a reduction in the 1000 seed weight in dusted plants (24%) when compared to control. On the contrary urea increased seed weight by 35% and ascorbic acid by 13.4% compared to control.

Table 4. Effect of cement dust, urea and ascorbic acid on panicle characters.

Panicle character	Control	Cement dust	Cement dust +urea	Cement dust + ascorbic acid
Number of panicle/plant	4.5	3.33	11.00	7.7
Panicle size (cm)	14.6	13.8	14.15	16.5
1000 grain wt (g)	11.2	24.0*	35.0+	13.4+

* Percent decrease over control; +percent increase over control.

Soil characters

The pH of soil from cement dusted plots increased from 7.5 to 9.75 at harvest whereas in the control plot it increased from 7.2 to 7.45 (Table 5). There was an increase in pH and electric conductivity in dusted plots compared to control.

DISCUSSION

Cement dust is known to show promotory and inhibitory effects based on the amount of dust load (Singh and Rao 1968). When the dust load was less till the 45th day, it has a stimulating effect and enhanced the biomass production of root and shoot. This result indicated that in initial stages, cement dust did not show toxic effect on the plant. The stimulating effect must have resulted from growth promoting substances such as calcium present in the dust. However, cement dust was observed to be toxic by decreasing biomass and length of root and shoot. The reduction could be attributed to the dust crust formed on the soil surface and changes in the physiochemical characters of soil (Table 5) which would possibly affect the mineral availability for plant metabolism. It is also likely that the reduction in the biomass may have resulted from a decreased photosynthetic function as the cement coating would interrupt absorption of light and diffusion of gases. Similar inhibitory effects on the biomass have also been reported in cotton (Oblisami *et al.,* 1978), maize (Parthasarathy et al., 1975) and what (Singh and Rao, 1978). In our observations, partial reversion in the reduction in biomass could be attained by urea and ascorbic acid treatments.

In dusted plants the number of leaves was more than that in control upto 60 days but later it reduced. Similar observations were made by Parthasarthy *et al.,* (1975) in maize growing in cement dust polluted area.

The observations have shown that rice plant was quite sensitive to cement dust as the 3 g/m^2 dust could affect the number, size of panicles and the seed weight. Along with the reduction in number of panicles, seed weight was reduced upto 24%. This could be due to the dust load on stigma which might partially prevent the germination of pollen grains leading to failure of fertilization (Anderson, 1914).

It is evident from the data that application of urea and ascorbic acid not only helped in reverting the toxic effect of cement dust but also increased seed weight by 35% and 13.4%, respectively. Though there was a continuous decrease in growth parameters with age and continuous dusting, such an effect was found minimized in urea and ascorbic acid treated plants. The promontory effects of urea and ascorbic acid must have resulted from the increased nitrogen availability and reducing power of ascorbic acid, respectively.

Continuous dusting of plants was found unharmful to growth till the 45th day. However, dusting thereafter has made the plants more susceptible. Therefore, amelioration practices should be extensively started beforehand to protect the plants from such a damage. In the present investigation, urea and ascorbic acid were found to be good ameliorators in this regard.

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